2016

M.Sc. Part–I Examination

PHYSICS

PAPER—IV

Full Marks : 75

Time : 3 Hours

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Use separate Answerscripts for Gr. A & Gr. B.

Group—A

[Marks—40]

Attempt Q. No. *1, 2, 3* and any *two* from the rest.

1. Answer any *five* questions : 5×2

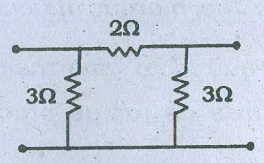
(a) Define (i) loss less transmission on line and (ii) distortion less transmission line.

(b) In case of radio wave propagation explain the terms : (i) skip distance and (ii) maximum usable frequency.

(c) Show that the instantaneous value of an amplitude modulated wave can be represented by the sum of three waves.

(d) Using radar range equation, explain how radar range can be increased ?

(e) Convert the following π-section into its equivalent T from.



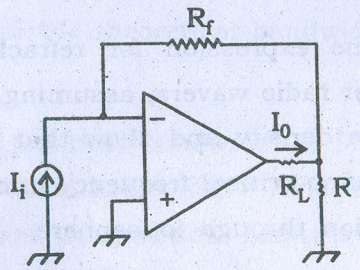
(f) Define reflection co-efficient of a transmission line. What would be its value if a line is terminated by its characteristic impedance ?

(g) Comment on the following terms in relation to an antenna : (i) induction field and (ii) radiation field.

(h) Why a photo-diode is operated in reverse bias only ?

2. Answer any *two* questions : 2×3

(a) Find out the expression for $\frac{I_0}{I_i}$ in the following circuit.



(b) A 3kW carrier signal is amplitude modulated (DSB-TC) by a single frequency sinusoidal signal. If the modulation index is 70%, determine the total power of the modulated wave. What is the power carried by the upper side band and lower side band ?

(c) As V_{GS} is changed from – 1V to – 1·5V keeping V_{DS} constant, I_D of a FET drops from 7 to 5 mA. Find the transconductance of the FET. If the ac drain resistance is 200 kΩ, find the amplification factor of the given FET.

3. Answer any *one* question : 1×4

(a) Explain the working principle of Doppler Radar.

(b) Define the characteristic impedance Z_0 of the transmission line. Deduce an expression of Z_0 in terms of transmission line parameters.

4. (a) What is CMRR ? 2

(b) Derive the expression for refractive index of ion sphere for radio wavers, assuming it has a constant ionisation density and show that it is less than 1. Hence define critical frequency in case of radio wave propagation through ionosphere. 5+1

(c) What is fading in radio waves ? 2

5. (a) Draw the circuit diagram of a constant - k high pass filter and show that it behaves as a constant - k filter. Derive the expressions for its cut-off frequency. 1+1+2

(b) Derive the expressions for α, β and nominal impedance in the pass band and in the attenuation band. Also graphically show their variations as a function of frequency in the pass band and in the attenuation band. 4+2

6. (a) Define frequency modulation. Derive the expression for frequency modulated signal which is modulated by a sinusoidal modulating signal and find out its spectral components. Represent the different

frequency compenents in frequency domain and hence find the theoretical bandwidth of F.M. 1+1+3+1

(b) Why the practical bandwidth of FM is not equal to the theoretical bandwidth ? Write the corresponding rule to find the practical bandwidth of F.M. 2

(c) What are the advantages of FM over AM ? 2

Group—B

[Marks—35]

Attempt Q. No. *1, 2* and any *two* from the rest.

1. Answer any *three* questions : 3×2

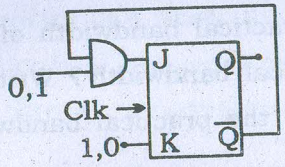
(a) Distinguish between combinational logic circuit and sequential logic circuit.

(b) What is parity generator ? Mention different types of parity generators. Describe its utility.

(c) What is the difference between RAM and SAM ?

(d) What are the different 'Flag' register in 8085 μp ?

(e) What will be output of the following circuit in two consequtive pulses ?



2. Answer any *three* bits : 3×3

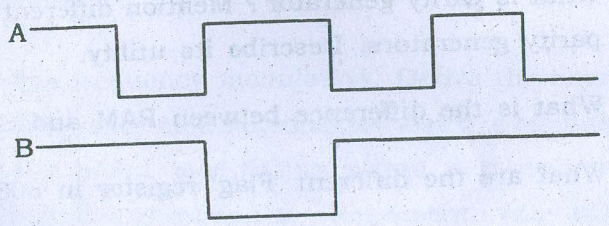
(a) Explain briefly TDM-PAM.

(b) Solve the following equation by K map.

$$Y = \sum m(4, 5, 8, 10) + d(12, 13)$$

(c) Give the idea of ADC by schematic diagram.

(d) Draw the output of the two input Ex-NOR gate with the given inputs A and B.

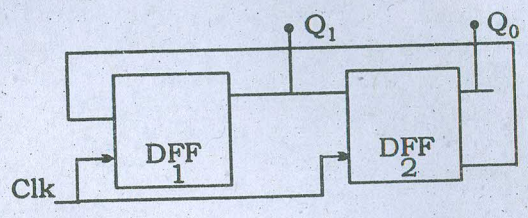


(e) Write the meaning of the following instructions :
(i) JNZ 400F (ii) INX H (iii) ADI 2A.

3. (a) Design a comparator circuit which can compare A > B, where A & B are three bit binary signals.

(b) Describe the process of 4 bit PISO register with neat diagram.

(c) Explain the output state of the following circuit starting from (0, 0) initial condition. 4+4+2



4. (a) Design a decade counter and draw the output waveforms.

(b) Expand the memory capacity from (32 × 4) to (128 × 8) with neat diagram.

(c) Give the block diagram of PCM transmission section in digital communication system. 4+4+2

5. (a) What do you mean by mnemonics and opcode ? What are the main features of 8085 μp ?

(b) Write a short note in A.L.U.

(c) Design Ex-nor gate memory by FPLA memory circuit.

4+4+2
